

**AFRL-SN-WP-TM-2003-1089**

**AFRL/GaAsTek HETEROJUNCTION  
BIPOLAR TRANSISTOR (HBT)  
PROCESS DEVELOPMENT**

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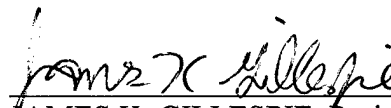
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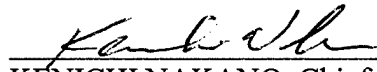
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This technical report has been reviewed and is approved for publication.

  
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<b>13. SUPPLEMENTARY NOTES</b>					
<b>14. ABSTRACT</b> A CRDA was established between Aerospace Components and Subsystem Division (AFRL/SND) and ITT GaAsTek to transfer the design, manufacture, and development of the Air Force's thermally shunted HBT (TSHBT) process to GaAsTek and to co-develop, design, and fabricate novel power amplifiers using GaAsTek's Process 5 MMIC foundry. GaAsTek was a well-known DoD MMIC foundry for high-power x-band amplifiers utilizing MESFET technology. AFRL/SND was known for developing a TSHBT capability for high power density devices. By working together, plans were made to transfer the TSHBT technology to GaAsTek. The Air Force was to benefit from this transfer by having a reputable DoD foundry be capable of manufacturing high-power amplifiers for Air Force system integration. Another added benefit would be having Air Force circuit designers work with a foundry to design and process novel power amplifiers for future Air Force system needs. GaAsTek was to benefit by gaining a new device capability, which could be used for commercial as well as military markets.					
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## **AFRL/GaAsTek HBT Process Development**

### **Introduction**

A CRDA was established between Aerospace Components and Subsystem Division (AFRL/SND) and ITT GaAsTek to transfer the design, manufacture, and development of the Air Forces thermally shunted HBT (TSHBT) process to GaAsTek and to co develop, design and fabricate novel power amplifiers using GaAsTek's Process 5 MMIC foundry. GaAsTek was a well-known DOD MMIC foundry for high power x-band amplifiers utilizing MESFET technology. AFRL/SND was known for developing a TSHBT capability for high power density devices. By working together plans were made to transfer the TSHBT technology to GaAsTek. The Air Force was to benefit from this transfer by having a reputable DoD foundry be capable of manufacturing high power amplifiers for Air Force system integration. Another added benefit would be having Air Force circuit designers work with a foundry to design and process novel power amplifiers for future Air Force system needs. GaAsTek was to benefit by gaining a new device capability, which could be used for commercial as well as military markets.

### **Discussion**

AFRL/SND hosted three GaAsTek process engineers for one week to demonstrate all aspects of the TSHBT process. Wafers were prepared ahead of time in order to be ready for each step of the process prior to their arrival in order to fully demonstrate these process steps. During this week long visit GaAsTek employees were able to see first hand each step of the high power TSHBT process developed at AFRL/SND. With the completion of the weeklong training, GaAsTek purchased wafers and processes were begun at their facility. All process documentation and test data from previously processed wafers were supplied to GaAsTek. In support of the transition SND engineers were available through phone conversations and email to help answer questions and review data.

When GaAsTek had completed the first lot of wafers at their facility three SND engineers traveled to visit their foundry. This reason for this visit was two fold. 1. help GaAsTek perfect a critical process step utilizing their facility and equipment, and 2. tour their MMIC foundry to determine which GaAsTek processes could be interchanged and still be able to complete the transfer. The critical process step was reviewed and the technique was fully understood by GaAsTek engineers during this visit. Existing GaAsTek processes were also considered as alternative approaches and advice given for implementation. While there, discussions took place as to the logistics of training Air Force engineers for designing into their foundry. Points of contact were exchanged and timelines discussed for this phase of the effort.

Shortly after the visit GaAsTek was purchased by M/A-COM Associates. With this change of leadership at GaAsTek came a shift in priorities within the engineering staff.

More focus was put on existing processes and products. Although GaAsTek was ready to fulfill the design and process portion of the agreement, AFRL/SND decided to not participate in this phase.

### **Conclusions**

The main objective of this agreement was to transfer the Air Force's TSHBT process to ITT GaAsTek. This transfer would give high power device technology to a commercial DoD MMIC foundry. The transfer took place by training device process engineers at SND, phone and email exchanges and traveling to GaAsTek for follow on training. GaAsTek was able to build working TSHBT devices at their facility. This collaboration came to a conclusion when the company was purchased by M/A-COM. The change of leadership caused more emphasis to be put on existing technologies. With less emphasis put on the development of the TSHBT process, AFRL/SND slowly reduced the amount of effort in the transfer.